

## PATENT

## REMARKS

Claims 1-46 are pending, of which claims 1, 9, 27 and 44 are independent. Claims 47 – 68 were previously cancelled without prejudice. Claims 1-6, 10-15, 17-28, 35-36 and 44 are amended. Claim 9 is cancelled without prejudice. After entry of this amendment, claims 1-6, 7-8 and 10-46 will be pending, of which claims 1, 27 and 44 are independent. Applicants believe that the present application is in condition for allowance, which prompt and favorable action is respectfully requested.

**I. REJECTION UNDER 35 U.S.C. §102**

The Office Action states that claims 1-9, 14-18, 20-30, 34-43 are rejected under 35 U.S.C. §102(b) as allegedly anticipated by US IEEE Publication VTS-2000 by Nguyen et al. The rejection is respectfully traversed in its entirety.

“A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.” *Verdegaal Bros. v. Union Oil of California*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987), *citing* 35 U.S.C. §102. *See also* MPEP § 2131.

The present claims are directed to a receiver and receive methods for use in a multiple-input multiple-output (MIMO) communication system. The receiver receives signals from multiple transmit antennas transmitting different streams of coded data. As shown in Fig. 4B, “[d]ecoder 430 within each decoder block 440 uses the decoder *a priori* information in the decoding process and provides the decoded data for the **transmit antenna assigned to and processed by the decoder block**.” Par. 1109 (bolding added). In other words, separate coded data streams are decoded for each transmit antenna. Throughput of a multiple-input multiple-output (MIMO) system can be increased if multiple independently coded and transmitted data streams can be received and decoded.

Contrarily, Nguyen teaches using “iterative demodulation and decoding of [a] concatenated” coded data stream. Specifically, Nguyen teaches that a differential space-time block code can be used as an inner code in a serial concatenated structure with an outer convolutional code and a random interleaver. (See Abstract.) Nguyen urges that using a

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differential space-time block code improves performance over a space-time block code. Nguyen does not teach independently coded data streams.

Referring to claim 1, the Applicants have amended claim 1 to include the limitation “determining the second extrinsic information based on the second plurality of soft decision symbols and *wherein the second extrinsic information is independent of the first extrinsic information;*” (emphasis added). Thus, the Applicants claim two independent sets of extrinsic information. The extrinsic information is a product of the decoding of the two independent data streams. The two claimed sets of extrinsic information are independent, because they are derived from independently coded data streams.

Referring again to claim 1, the applicant claims, among other things “*determining a first plurality of soft decision symbols* for a first subset of the transmitted coded bits based on the received plurality of modulation symbols and first extrinsic information for the transmitted coded bits” (emphasis added), and “determining the first extrinsic information based on the first plurality of soft decision symbols”. Further, in claim 1, the applicant claims, among other things, “*determining a second plurality of soft decision symbols* for a second subset of the transmitted coded bits based on the received plurality of modulation symbols and second extrinsic information for the transmitted coded bits” (emphasis added), and “determining the second extrinsic information based on the second plurality of soft decision symbols”.

As described above, the receiver receives independently coded data streams. The independently coded data streams are the received plurality of modulation symbols. Thus, the modulation symbols are independent. Since the modulation symbols are independent, the soft decision symbols and the extrinsic information based on the modulation symbols are independent.

Nguyen does not teach independent soft decision symbols or independent extrinsic information. Accordingly, amended claim 1 is allowable.

In section 4 of the Office Action it states “Regarding claims 34, 35 and 36, Nguyen discloses at least one decoder is provided for each independently coded data stream to be decoded by the receiver and is operative to perform decoding on the first a priori information (page 2396, section 2.2., fig. 3).” The Applicants respectfully disagree. Nowhere in Nguyen page 2396, or section 2.2. or Fig. 3 are independently coded data streams taught.

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Contrarily, Nguyen describes a differential space time block code (DSTBC) with serially concatenated recursive encoding. Nguyen shows that DSTBC can be used with recursive coding/decoding and a Viterbi algorithm. Page 2394, col. 2.

Nguyen does not even describe multiple data streams, let alone independently coded data streams. Accordingly, Nguyen does not expressly or inherently describe the claimed "second extrinsic information... independent of the first extrinsic information." Further, Nguyen does not teach the other claimed limitations cited above, namely, "*determining a first plurality of soft decision symbols* for a first subset of the transmitted coded bits based on the received plurality of modulation symbols and first extrinsic information for the transmitted coded bits" (emphasis added), "*determining the first extrinsic information based on the first plurality of soft decision symbols*", "*determining a second plurality of soft decision symbols* for a second subset of the transmitted coded bits based on the received plurality of modulation symbols and second extrinsic information for the transmitted coded bits" (emphasis added), and "*determining the second extrinsic information based on the second plurality of soft decision symbols*". Indeed, Nguyen does not describe soft decision symbols at all. Accordingly, claims 34, 35 and 36 are allowable.

Claim 27 is an apparatus claim with a similar scope to method claim 1. Claim 27 claims, among other things, "wherein the first subset of the first *a priori* information is independent from the second subset of the first *a priori* information." Accordingly, claim 27 is patentable for at least the reasons discussed above with respect to claim 1.

Claim 44 is a means-plus-function claim with similar scope to apparatus claim 27. Accordingly, claim 44 is patentable for at least the reasons discussed above with respect to claim 1.

All pending dependent claims depend from one of claim 1, claim 27 and claim 44. Accordingly, all pending claims are allowable for at least the reasons discussed above with respect to claim 1, claim 27 or claim 44.

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**II. REJECTION UNDER 35 U.S.C. §103**

The Examiner rejected claims 10-13, 19, 31-33, 44-46 under 35 U.S.C. §103 as being unpatentable over US IEEE Publication VTS-2000 by Nguyen et al in view of Marzetta (U.S. Patent No. 6,307,882). This rejection is traversed as follows.

The basic requirements of a prima facie case of obviousness under 35 USC 103 are: (1) there must be some suggestion or motivation to modify the reference or to combine the reference teachings; (2) there must be a reasonable expectation of success in modifying the reference or combining the references; and (3) the prior art must teach or suggest all the claim limitations. MPEP § 2143.

**A. Claims 10-13 and 19**

The Applicants submit that Nguyen and Marzetta do not, either individually or in combination, teach or suggest the claimed limitation “determining the second extrinsic information based on the second plurality of soft decision symbols and *wherein the second extrinsic information is independent of the first extrinsic information;*” (emphasis added) of claim 1. This limitation is not described by Nguyen as explained above. Further, Marzetta does not cure the defect, that is, Marzetta also does not teach or suggest “wherein the second extrinsic information is independent of the first extrinsic information”.

As described above, Nguyen teaches using “iterative demodulation and decoding of [a] concatenated” coded data stream. Specifically, Nguyen teaches that a differential space-time block code can be used as an inner code in a serial concatenated structure with an outer convolutional code and a random interleaver. (See Abstract.) Nguyen urges that using a differential space-time block code improves performance over a space-time block code. Nguyen does not teach independently coded data streams.

Marzetta teaches improving a receiver performance in a MIMO communication system by transmitting a known training sequence to enable the receiver to estimate the channel characteristics from each transmit antenna to each receive antenna. Marzetta gives several techniques tending to further improve the performance the described communication system. For example, Marzetta suggests that if M transmit antennas are employed, and the training sequence includes T symbols, then improved performance can be achieved by assuring that  $T \geq M$ . Other

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techniques that generally relate to the best type of training signal are given. But none of the techniques given and nothing in Marzetta teaches or suggests multiple independent data streams.

Marzetta is directed to improving receiver performance by transmitting a training sequence, and methods relating to optimizing the training sequence, not to improving data throughput by transmitting and receiving independently coded data streams.

Accordingly, Marzetta does not teach or suggest the claim 1 limitation “determining the second extrinsic information based on the second plurality of soft decision symbols and *wherein the second extrinsic information is independent of the first extrinsic information*” (emphasis added). Since claims 10-13 and 19 depend from claim 1, claims 10-13 and 19 are allowable for at least the reasons described above with respect to claim 1.

Further, Marzetta does not teach or suggest the other claimed limitations of claim 1 cited above, namely, “*determining a first plurality of soft decision symbols* for a first subset of the transmitted coded bits based on the received plurality of modulation symbols and first extrinsic information for the transmitted coded bits” (emphasis added), “determining the first extrinsic information based on the first plurality of soft decision symbols”, “*determining a second plurality of soft decision symbols* for a second subset of the transmitted coded bits based on the received plurality of modulation symbols and second extrinsic information for the transmitted coded bits” (emphasis added), and “determining the second extrinsic information based on the second plurality of soft decision symbols”. Marzetta is not concerned with soft decision symbols, extrinsic information or *a priori* information and, as such, does not cure the deficiencies of Nguyen in teaching any of the above-referenced limitations.

Further still, the teaching of Nguyen and Marzetta, if combined, do not implicitly disclose the claimed invention. See MPEP § 2144.01. As stated above, Nguyen teaches using “iterative demodulation and decoding of [a] concatenated” coded data stream. Specifically, Nguyen teaches that a differential space-time block code can be used as an inner code in a serial concatenated structure with an outer convolutional code and a random interleaver. (See Abstract.) Nguyen urges that using a differential space-time block code improves performance over a space-time block code. Nguyen does not teach independently coded data streams. Contrarily, as stated above, Marzetta teaches improving a receiver performance in a MIMO communication system by transmitting a known training sequence to enable the receiver to estimate the channel

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characteristics from each transmit antenna to each receive antenna. Marzetta gives several techniques tending to further improve the performance of the described communication system. For example, Marzetta suggests that if  $M$  transmit antennas are employed, and the training sequence includes  $T$  symbols, then improved performance can be achieved by assuring that  $T \geq M$ . Other techniques that generally relate to the best type of training signal are given. But none of the techniques given and nothing in Marzetta teaches or suggests multiple independent data streams.

Therefore, even if Marzetta could be combined with Nguyen, modifying Nguyen according to the teaching of Marzetta, would not achieve the multiple independent data streams of claims 10-13 and 19. Accordingly, claims 10-13 and 19 are allowable.

B. Claims 31-33

The Applicants submit that Nguyen and Marzetta do not, either individually or in combination, teach or suggest the claimed limitation "wherein the first subset of the first *a priori* information is independent of the second subset of the first *a priori* information" of claim 27. All of the arguments given above with respect to the claim 1 limitation "determining the second extrinsic information based on the second plurality of soft decision symbols and *wherein the second extrinsic information is independent of the first extrinsic information;*" (emphasis added) apply to the claim 27 limitation "wherein the first subset of the first *a priori* information is independent of the second subset of the first *a priori* information", because both the cited claim 1 limitation and the cited claim 27 limitation require independent streams of data. This limitation is not described by Nguyen as explained above. Further, as described above with respect to claims 10-13 and 19, Marzetta does not cure the defect, that is, Marzetta also does not teach or suggest "wherein the first subset of the first *a priori* information is independent of the second subset of the first *a priori* information". Since claims 31-33 depend from claim 27, claims 31-33 are allowable for at least the reasons described above with respect to claim 27.

C. Claims 44-46

The Applicants submit that Nguyen and Marzetta do not, either individually or in combination, teach or suggest the claimed limitation "wherein the first subset of the first *a priori* information is independent of the second subset of the first *a priori* information" of claim 44. All of the arguments given above with respect to the claim 1 limitation "determining the second

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extrinsic information based on the second plurality of soft decision symbols and *wherein the second extrinsic information is independent of the first extrinsic information;*" (emphasis added) apply to the claim 44 limitation "wherein the first subset of the first *a priori* information is independent of the second subset of the first *a priori* information", because both the cited claim 1 limitation and the cited claim 44 limitation require independent streams of data. This limitation is not described by Nguyen as explained above. Further, as described above with respect to claims 10-13 and 19, Marzetta does not cure the defect, that is, Marzetta also does not teach or suggest "wherein the first subset of the first *a priori* information is independent of the second subset of the first *a priori* information". Since claims 45-46 depend from claim 44, claims 45-46 are allowable for at least the reasons described above with respect to claim 44.

**II. REJECTION UNDER 35 U.S.C. §103**

The Applicants have reviewed the other references made of record by the Office Action. The Applicants assert that the claimed invention is patentably distinct from the other references made of record.

**PATENT****REQUEST FOR ALLOWANCE**

In view of the foregoing, the Applicants submits that all pending claims in the application are patentable. Accordingly, reconsideration and allowance of this application are earnestly solicited. Should any issues remain unresolved, the Examiner is encouraged to telephone the undersigned at the number provided below.

Respectfully submitted,

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